

2 – Northwest Indiana Exceptional Events Detail

Parameter:	PM _{2.5}
Dates:	May 23, 24, 29 - 31, 2007
Location:	Michigan City, LaPorte/ Dunes Lakeshore, Ogden Dunes - LaPorte / Porter Co.
Event:	Smoke from wildfires in northern Florida and southern Georgia impacted the Northwest Indiana region during the period of May 23 – 31. The buildup of smoke moving through the area during this period resulted in an exceedance of the 24-hour PM _{2.5} NAAQS on May 29 th at Michigan City (18-091-0005) and several elevated readings throughout the region.
Data:	<p>Different analyses of the data are used to demonstrate that the PM_{2.5} concentrations measured from May 23 – 31 are beyond the range of values typically found during that time period and that they have been influenced by outside events. Table 2.1 shows daily PM_{2.5} averages prior to, during and after the event with the values flagged in bold. Data have been flagged with an exceptional event flag of 'E' in AQS, awaiting concurrence from EPA.</p> <p>Tables 2.2 and 2.3 list summaries of the data collected in LaPorte and Porter counties sites since 2000. Data from 2007 are calculated with all current data and with the flagged data removed. There is an improvement in the Michigan City and LaPorte daily design values (2005-2007) and an improvement in all of the annual averages at all sites when the flagged data are removed.</p>

**Table 2.1 - FRM Daily Values
Exceptional Event Period**

Values in **BOLD** are flagged as exceptional events

Date	Michigan City - Marsh 18-091-0011	LaPorte 18-091-0012	Dunes Nat'l Lakeshore 18-127-0020	Ogden Dunes 18-127-0024
5/17/07	3.7			
5/18/07	7.5	6.3	7.2	
5/19/07	9.5			
5/20/07	5.6			
5/21/07	11.3	11.8	10.8	
5/22/07	16.6			
5/23/07	31.7			
5/24/07	27.9	27	25.8	27.9
5/25/07	9.1			
5/26/07	12.5			
5/27/07	10.1	8.8	8.9	9.3
5/28/07	12.6			
5/29/07	36.7			
5/30/07	31.5	31	30.1	31.5
5/31/07	30.2			
6/1/07	18.4			
6/2/07	10.7	11.6	10.4	11.4

Table 2.2 - Historical Daily Values

		Michigan City 180910011		LaPorte 180910012		Dunes Lakeshore 181270020		Ogden Dunes 181270024	
Year		98th %ile	Daily Design Value ¹	98th %ile	Daily Design Value ¹	98th %ile	Daily Design Value ¹	98th %ile	Daily Design Value ¹
2000		28.5		29.7		27.3		32	
2001		33.7		36.1		35.2		34.8	
2002	2000- 2002	31.3	31	31.5	32	30.5	31	32.9	33
2003	2001- 2003	31.8	32	32.4	33	31.7	32	30.7	33
2004	2002- 2004	31.6	32	26.6	30	29.7	31	29.1	31
2005	2003- 2005	37.5	34	36.5	32	37.6	33	37.5	32
2006	2004- 2006	25.5	32	24.7	29	26.6	31	26.1	31
2007	2005- 2007	31.5	32	31	31	30.6	32	33.3	32
		Values Excluding Flagged Data							
2007	2005- 2007	29.1	31	30.1	30	30.6	32	33.3	32

¹ Daily Design Value = 3 year average of annual 98th %ile values.

Table 2.3 - Historical Annual Averages

		Michigan City 180910011		LaPorte 180910012		Dunes Lakeshore 181270020		Ogden Dunes 181270024	
Year		Annual Ave.	Annual Design Value ²	Annual Ave.	Annual Design Value ²	Annual Ave.	Annual Design Value ²	Annual Ave.	Annual Design Value ²
2000		13.4		12.6		13.5		14.5	
2001		14.2		14.2		13.6		14.2	
2002	2000- 2002	13.2	13.6	13.5	13.4	13.2	13.5	14.2	14.3
2003	2001- 2003	12.8	13.4	13.2	13.6	13.2	13.4	12.9	13.8
2004	2002- 2004	12.1	12.7	11.9	12.9	11.8	12.8	12.4	13.2
2005	2003- 2005	13.6	12.8	14.1	13.1	14	13	14.6	13.3
2006	2004- 2006	11.1	12.3	11.4	12.5	11	12.3	11.8	12.9
2007	2005- 2007	12.4	12.4	12.1	12.5	13	12.7	13.8	13.4
		Values excluding flagged data							
2007	2005- 2007	12.1	12.3	11.8	12.4	12.7	12.6	13.5	13.3

²Annual Design value = 3 year average of the annual averages.

Particulate

Composition: Speciation data are collected at the Gary – IITRI and Hammond - Purdue sites in Lake County on a one in six day sampling schedule. Data are available for May 24 and May 30. High organic carbon values were reported on those two dates; 9.35 ug/m³ and 8.17 ug/m³ at Gary and 9.86 ug/m³ and 8.07 ug/m³ at Hammond, respectively. These values were the highest values of the year at these two sites. The annual average for organic carbon is 3.45 ug/m³ at Gary and 3.23 ug/m³ at Hammond. The elemental carbon values were very near the annual average concentrations. The high organic carbon values, without an increase in elemental carbon, are a very good indicator of biomass combustion.

The maps in Appendix 3 indicate that the regional organic carbon values were elevated on the two available sample days. The time progression of the maps shows the rise and fall of the organic carbon values over this time period.

Maps: Images of maps from NOAA Satellite and Information Services show the smoke plume originating from the northern Florida/southern Georgia region. Dispersion and movement of the smoke plume from these fires was generally to the west or northwest and then to the north. The daily satellite smoke photos show that the smoke plume from the fires extend statewide on May 23 and 24. The plume recedes back to the south and east until May 29. It continues to influence all sites statewide until May 31. The daily

wind roses (obtained from the nearest meteorological site at Gary - IITRI, 18-089-0022) show information on prevailing wind direction, calm conditions and wind speed. NOAA weather maps are also used to show that an upper level trough greatly influences the direction of the plume in relation to the Northwest Indiana region.

Trajectory
Modeling:

The NOAA HYSPLIT Models are used to show wind trajectories at different levels during this event. Backward modeling from the site (latitude: 41.60°; longitude: -86.73°) at elevations of 25m, 150m and 500m was conducted for a period of three (3) to four (4) days prior. The differing elevations were chosen to demonstrate the air mass's uniformity at ground-level where the samplers were located and aloft which avoids the ground-level limitations of the model. Forward modeling was conducted using the Bugaboo Scrub Fire as the starting point (latitude: 30.70°; longitude: -82.40°) at an elevation of 250 meters (appropriate height that is low enough to always be in the well-mixed zone and high enough to avoid the ground-level model limitation) and going three (3) to four (4) days. Overall, there is a very good correlation when comparing the forward and backward trajectories for a given date. May 24 and 30 show a very narrow channel of air flow between southeastern Georgia and Northwest Indiana, with similar results on other days. The forward trajectory models are in Appendix 2.

Conclusion:

EPA defines an “exceptional event” as an unusual or naturally occurring event that can affect air quality but is not reasonably controllable by state and local agencies. Exceptional events are events for which the normal planning and regulatory process established by the clean air act is not appropriate. Indiana has illustrated through the use of maps, meteorological data, speciation data, trajectory models and historical data that the smoke from wildfires in Florida and Georgia impacted the Northwest Indiana region on May 23, 24, 29 – 31, 2007 causing an exceedance of the PM_{2.5} 24-hour standard and significantly increasing the annual average. According to 40 CFR Part 50.14 (b)(1), “EPA shall exclude data from use in determinations of exceedances and NAAQS violations where a State demonstrates to EPA’s satisfaction that an exceptional event caused a specific air pollution concentration in excess of one or more national ambient air quality standards at a particular air quality monitoring location and otherwise satisfies the requirements of this section.” IDEM believes they have successfully illustrated the impact of this event on the sites in this region.

Therefore, IDEM requests that EPA concur with the ‘E’ flag on the data in AQS for the data in **bold** in Table 2.1.

NOAA Satellite Smoke Maps, Weather Maps, and Wind Roses

The smoke map shows that the plume has reached the Northwest Indiana region and as shown in Table 2.1, PM_{2.5} levels have started to increase. The corresponding wind rose and weather map further illustrate the direction of the plume by the location of the upper level trough (orange dashed line) and the S, SW prevailing winds.

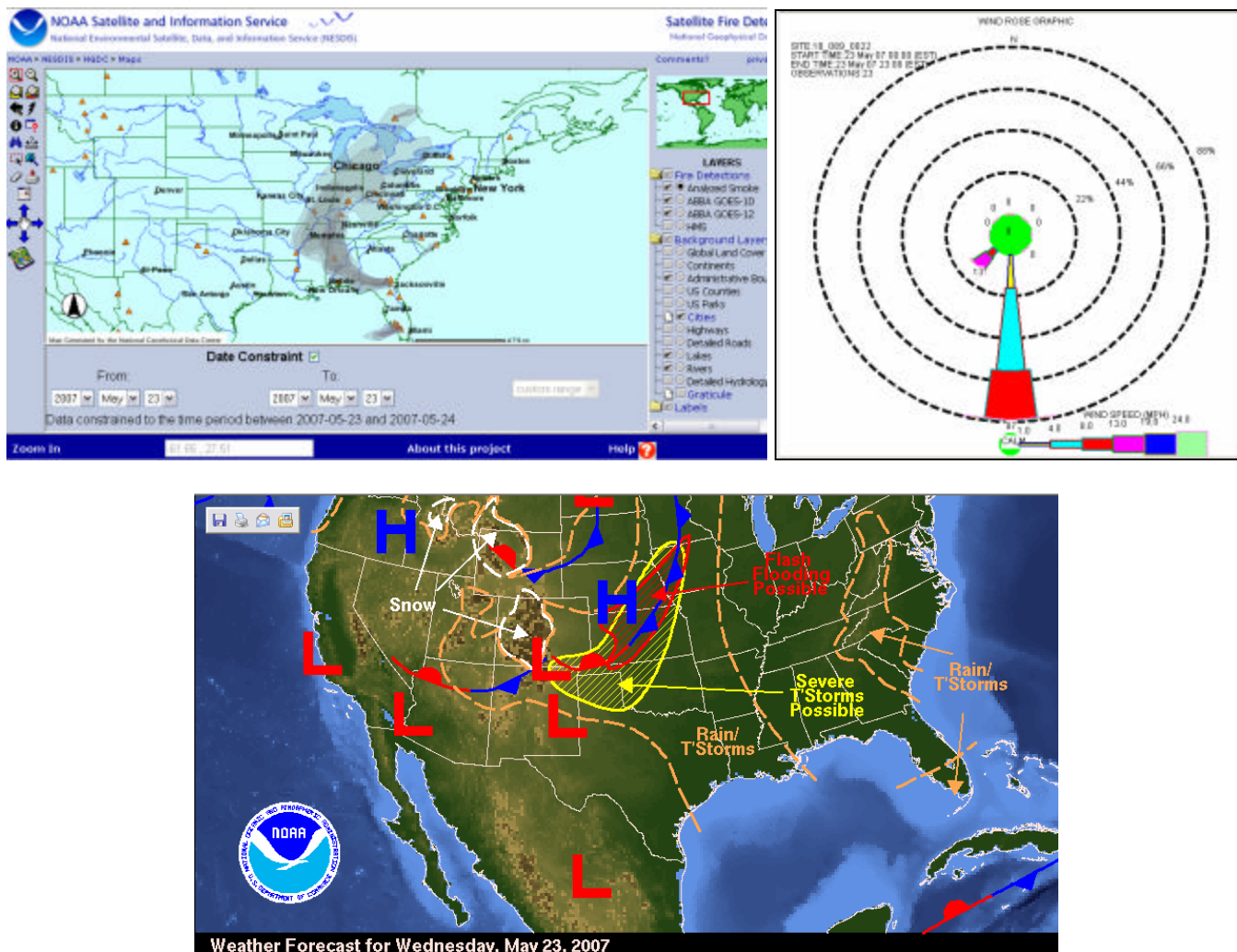


Figure 2.1 - May 23, 2007

The smoke map shows that the plume is remaining over the area. The prevailing wind direction continues to be directly from the south as the upper level trough moves further to the east and another trough develops over Ohio, keeping the plume over the northern Indiana region.

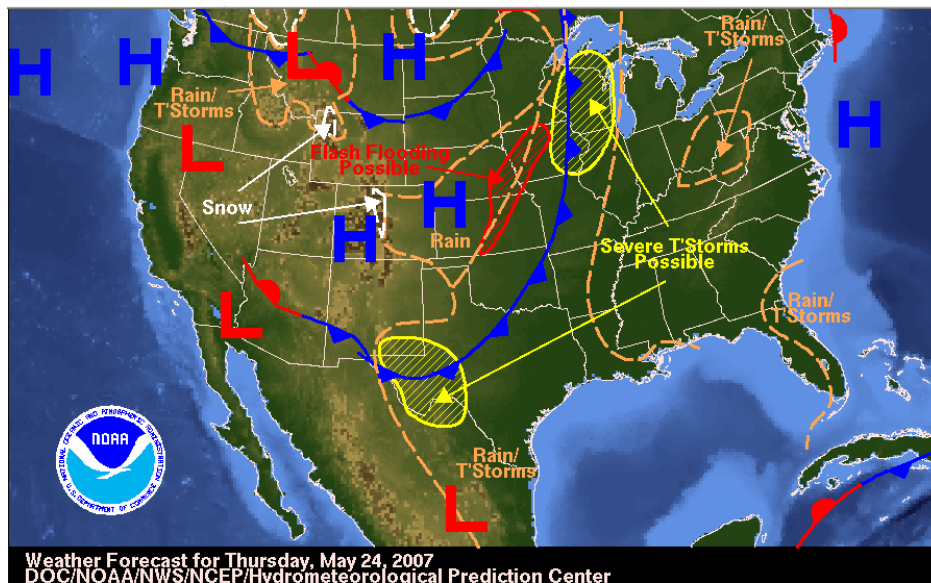
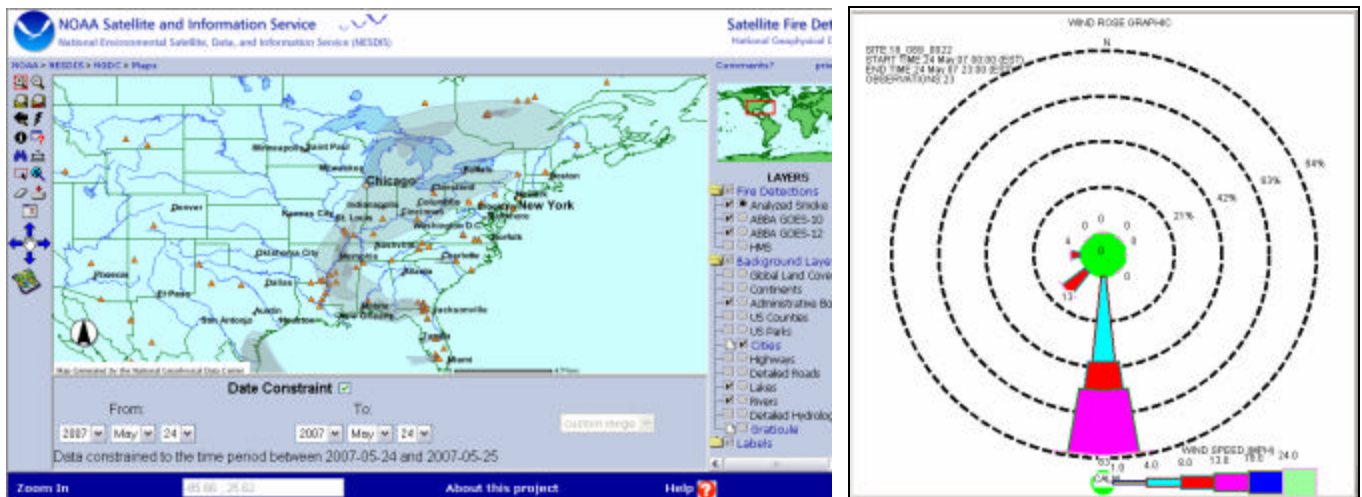


Figure 2.2 - May 24, 2007

Although the map illustrates the plume is not over the region, the prevailing SE wind direction, as shown by the wind rose, keep the high levels of PM_{2.5} over the area.

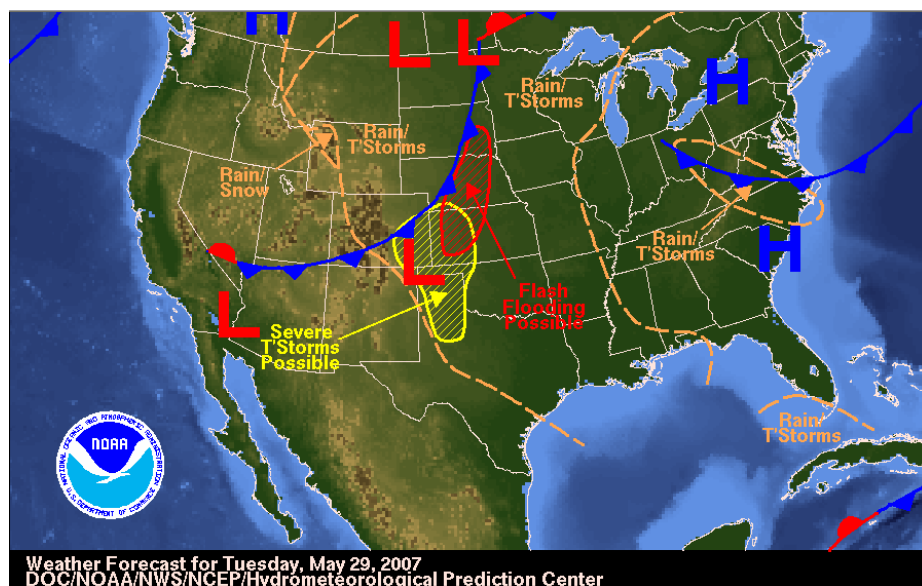
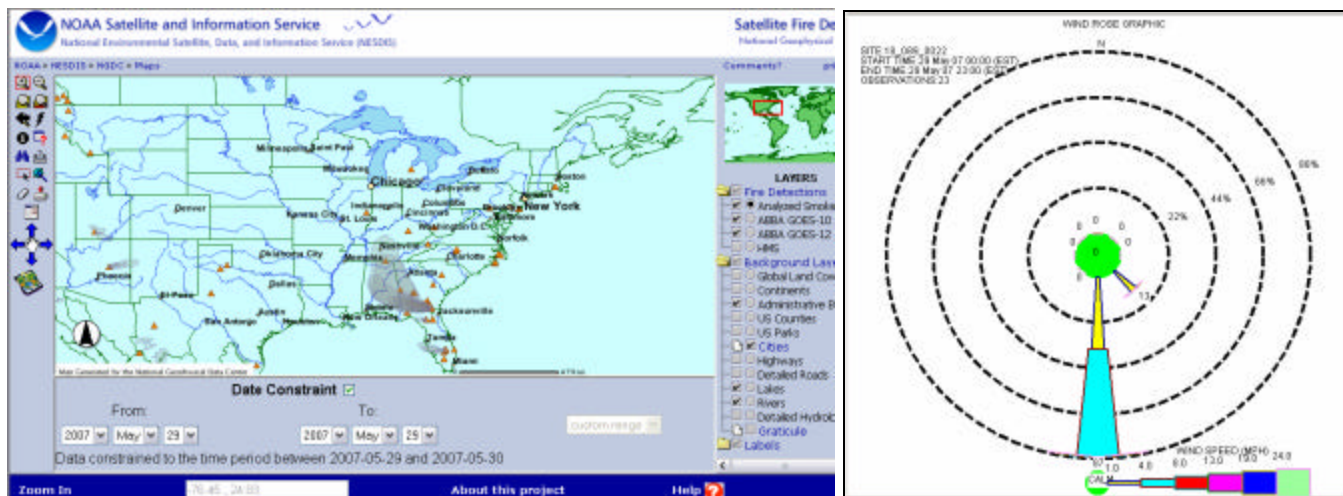


Figure 2.3 - May 29, 2007

The map shows the plume has moved back over the region as the upper level trough dips down over the area and the wind direction continues to be from the south.

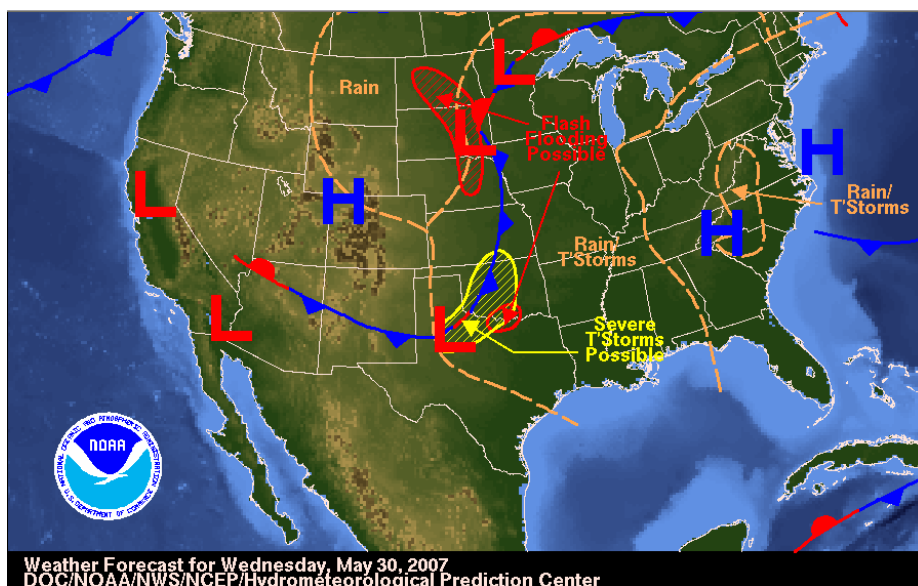
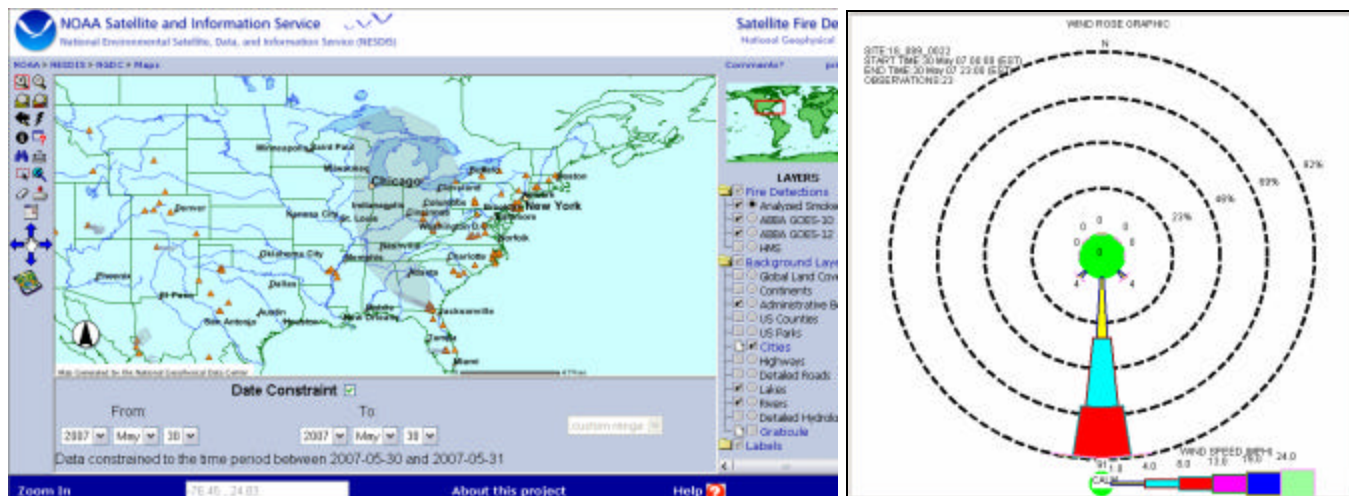


Figure 2.4 - May 30, 2007

The map shows the plume has dissipated as the upper level trough moves to the east. However, a stronger southerly wind direction keeps the high levels over the area.

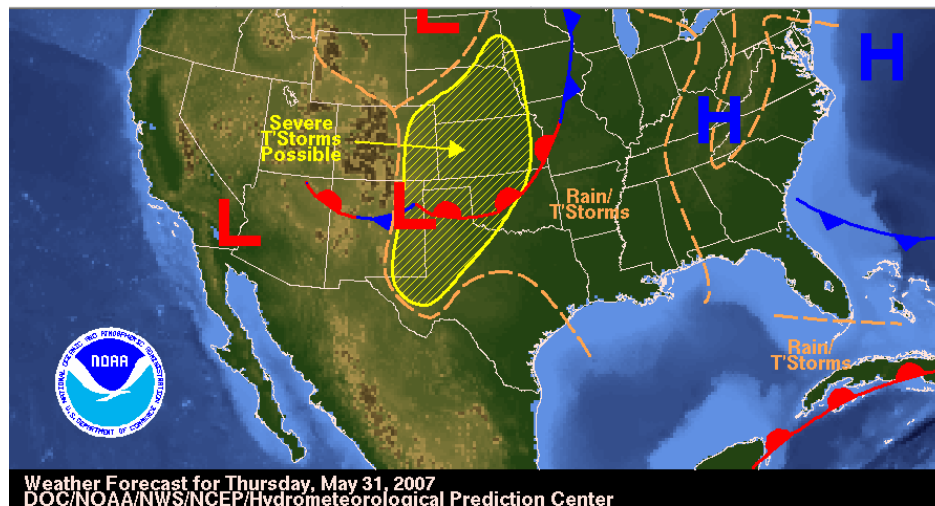
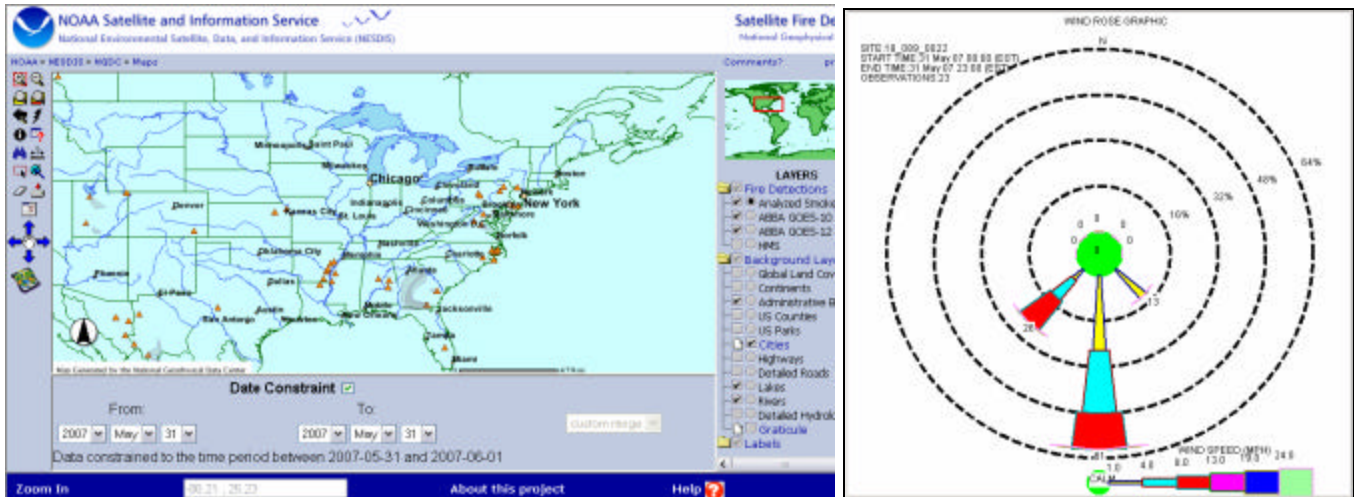


Figure 2.5 - May 31, 2007

Backward Trajectory Models

NOAA ARL READY HYSPLIT Maps

Draxler, R.R. and Rolph, G.D., 2003. HYSPLIT (HYbrid Single-Particle Lagrangian Integrated Trajectory) Model access via NOAA ARL READY Website (<http://www.arl.noaa.gov/ready/hysplit4.html>). NOAA Air Resources Laboratory, Silver Spring, MD.

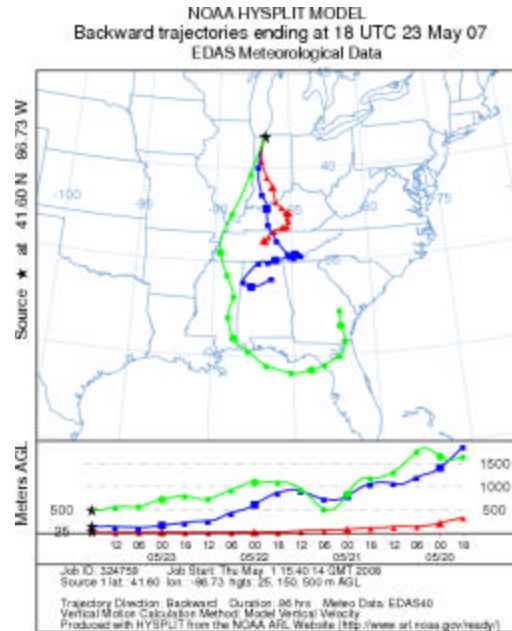


Figure 2.6: Backward trajectories originating from NW Indiana on 5/23/07 at 12:00 PM CST showing the higher level air mass passing over Florida and Georgia. Note: the lowest-level trajectory breaks down due to the model predicting a zero elevation air mass.

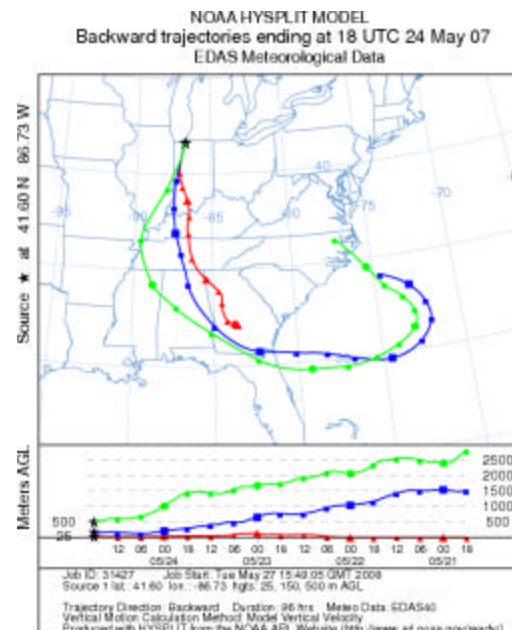


Figure 2.7: Backward trajectories originating from NW Indiana on 5/24/07 at 12:00 PM CST showing the air mass passing over southern Georgia and northern Florida.

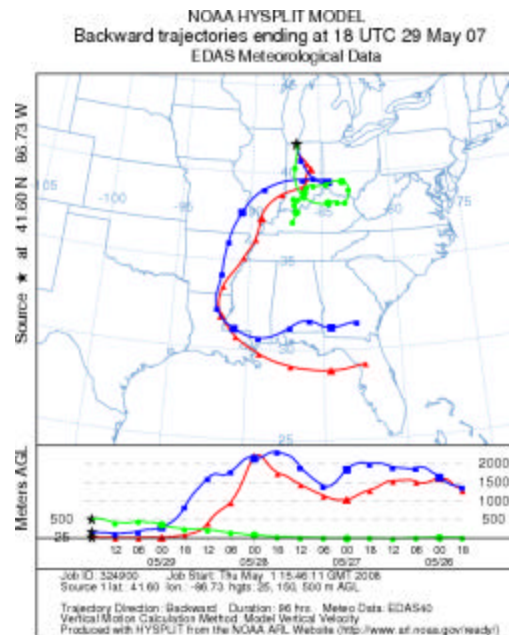


Figure 2.8: Backward trajectories originating from NW Indiana on 5/29/07 at 12:00 PM CST showing the air mass still passing over northern Florida.

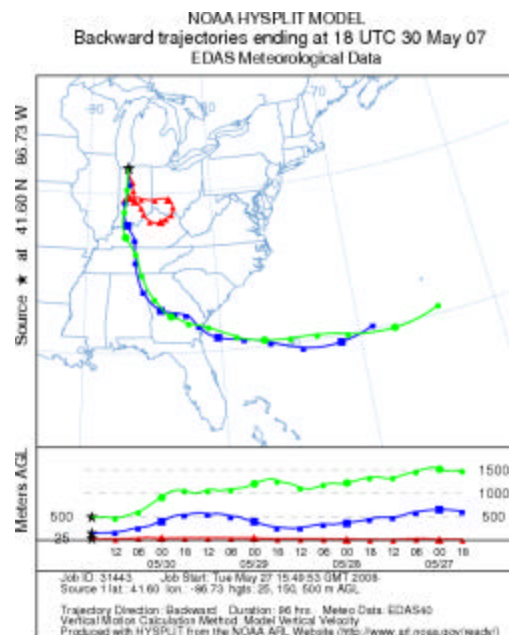


Figure 2.9: Backward trajectories originating from NW Indiana on 5/30/07 at 12:00 PM CST showing the air mass still passing over southern Georgia.

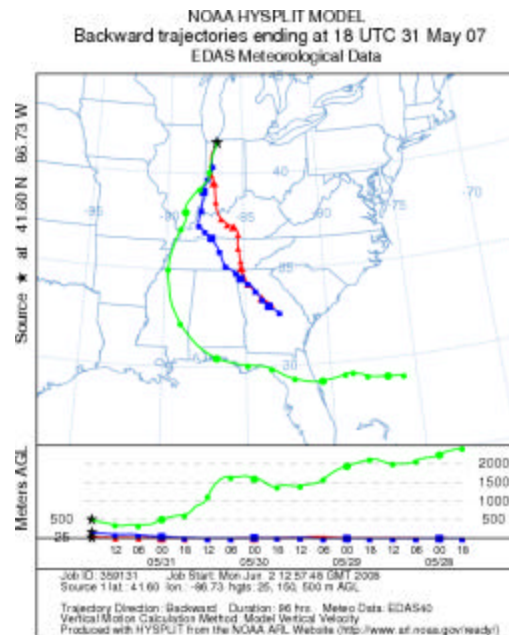


Figure 2.10: Backward trajectories originating from NW Indiana on 5/31/07 at 12:00 PM CST showing consistency in the air mass passing over northern Florida.